# Streamwalk 2004
# Philipstown, NY
## Foundry Brook, Indian Brook, Philipse Brook & Clove Creek

Hudson River Estuary

Hudson Highlands Land Trust

## ACKNOWLEDGEMENTS

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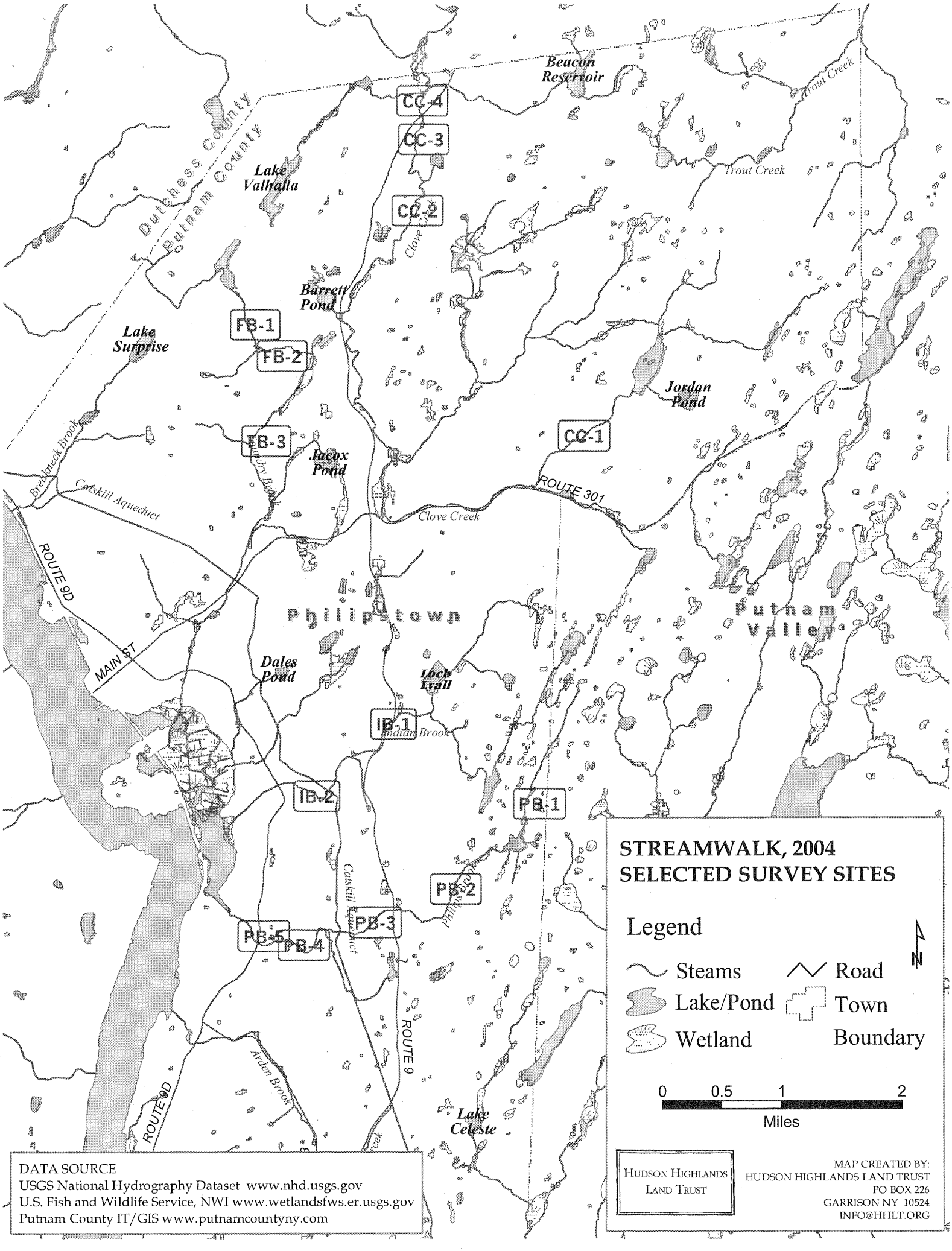
Beacon Reservoir
Trout Creek
Trout Creek
Dutchess County
Putnam County
Lake Valhalla
CC-4
CC-3
CC-2
Clove Creek
Barrett Pond
Lake Surprise
FB-1
FB-2
FB-3
Jacox Pond
Jordan Pond
CC-1
ROUTE 301
Clove Creek
Breakneck Brook
Catskill Aqueduct
ROUTE 9D
MAIN ST
Philipstown
Putnam Valley
Dales Pond
Loch Lyall
IB-1
Indian Brook
IB-2
PB-1
PB-2
PB-3
PB-4
PB-5
Catskill Aqueduct
Philips Brook
ROUTE 9
ROUTE 9D
Arden Brook
Lake Celeste
STREAMWALK, 2004
SELECTED SURVEY SITES
Legend
Steams
Lake/Pond
Wetland
Road
Town
Boundary
N
0
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Miles
DATA SOURCE
USGS National Hydrography Dataset www.nhd.usgs.gov
U.S. Fish and Wildlife Service, NWI www.wetlandsfws.er.usgs.gov
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## SUMMARY

In the summer of 2004, the Hudson Highlands Land Trust worked with volunteers from the community to complete habitat assessments along select stream segments in Philipstown. The assessment focused on the physical and biological characteristics of 4 major streams in Philipstown; Foundry Brook, Indian Brook, Philipse Brook and Clove Creek. The analysis was designed take a "snapshot" of the current conditions. This baseline information can be used to track future changes and measure the impacts of those changes.

## INTRODUCTION

Streams are complex systems where a variety of physical, biological and chemical factors interact. For example, fish and aquatic insects rely on rocks, logs and roots for shelter; vegetation and other tiny animals to eat; dissolved oxygen to breathe and special places to breed and hatch their young. Some fish and aquatic insect survival is also dependent on the depth, velocity and temperature of water.

Streams are also important to terrestrial animals. Birds and other animals bathe in streams while others come in search of food. In contrast, amphibians may visit the stream only once in their entire life cycle for breeding.

The role streams play in human life is not limited to outdoor recreation. After heavy rains streams act as natural storm water management systems as they carry excess storm water downstream. If the amount of precipitation exceeds the capacity of the stream, natural floodplains reduce the impact of floodwaters. Streams also play an important role in groundwater recharge. Groundwater resources are recharged as water seeps though the streambed.

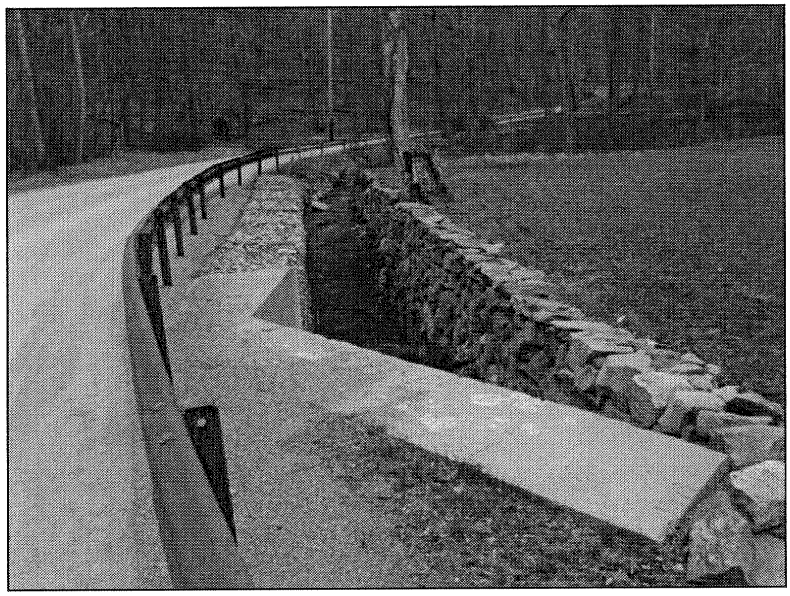
There are approximately 200 miles of stream corridor in Philipstown. These corridors provide a variety of habitats to a diverse population of flora and fauna.

## RESULTS

### Foundry Brook

Foundry Brook flows approximately 5.5 miles from its headwaters on Breakneck Ridge in the North Highlands to Foundry Cove in Cold Spring where it enters the Hudson River. Foundry Brook is the primary source for municipal water services to the Villages of Nelsonville and Cold Spring. The Upper Cold Spring Reservoir is located close to the headwaters at an altitude of 650 feet. The Lower Reservoir is located on the southern side of Fishkill Road. Jaycox Pond, approximately 12 acres in size is in the watershed of Foundry Brook.

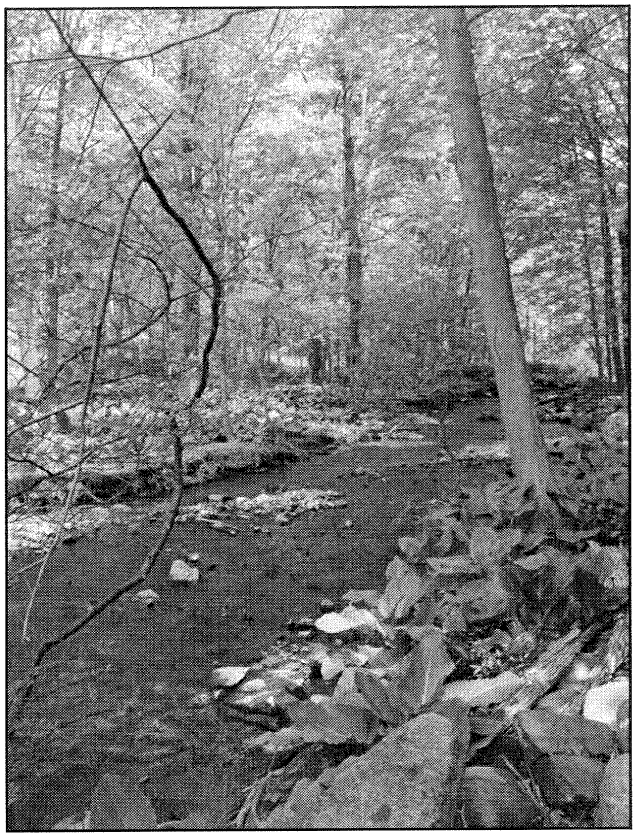
Three stream segments were selected for assessment. Foundry Brook 1 (FB-1) and Foundry Brook 2 (FB-2) were located just below the Upper Cold Spring Reservoir on the east and west side of Foundry Pond Road. Foundry Brook 3 (FB-3) stretched from the DEC regulated wetland on Fishkill Rd to the Lower Cold Spring Reservoir. Weather conditions were clear or overcast with no precipitation recorded 48 hours preceding each Streamwalk along Foundry Brook. Surrounding land use of each stream segment was forested or rural residential.



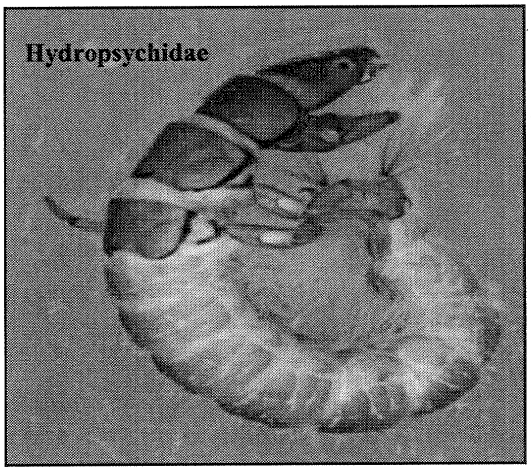
**Channelized Segment at FB-1**

The lowest habitat assessment score along Foundry Brook was the FB-1 segment. This segment was a straightened channel approximately 150 ft in length, with no tree canopy cover. Streamside vegetation can help to keep water cool by providing shade. The cement banks along FB-1 prevented stream water access to its natural floodplain and could increase stream velocity. Flooding is an important process in maintaining the overall health of a stream. As with most channelized stream segments, FB-1 lacked pools. Water appeared very clear and there was little evidence of nutrient enrichment. No fish barriers were identified.

FB-2 had the highest overall assessment factor score of the Foundry Brook segments. This segment was approximately 200 ft of meandering stream with a healthy streamside cover and riparian zone, just downstream from FB-1. Water was very clear with little sign of nutrient enrichment. Few pools were noted and streamside banks were moderately unstable and showed some sign of erosion. The erosion is most likely as a result of increased energy upstream in FB-1. Less than half of the bank was covered by vegetation and exposed tree roots systems were noted. Wildlife observations included a few squirrels, a variety of birds and mink tracks. Fish identified in the segment included 30 Blacknose Dace, 3 creek chub and 3 Tesselated Darter.



**Macroinvertebrate collection site at FB-2**



**Hydropsychidae**

Macroinvertebrate analysis was used to better understand the existing habitat and overall health of the each stream. Different macroinvertebrate species respond to different types of stressors and habitat types. Therefore, by identifying the macroinvertebrate species living in the stream, conclusions can be drawn about the stream habitat

Macroinvertebrate analysis was completed at FB-2. The dominant family was Hydropsychidae, Common Netspinner, representing 55% of the sample. The Total Family Richness calculation, a representation of the total number of macroinvertebrate species in the stream, indicated the segment was *moderately impacted.*

The EPT calculation result was *slightly impacted.* EPT Richness is the number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa found in a stream reach. Mayflies, stoneflies, and caddisflies are typically

used in biological monitoring because they are generally intolerant of silt, warm temperatures, and water quality degradation.

As the stream flows under Fishkill Rd just downstream from the DEC regulated wetland on Fishkill Rd marked the beginning FB-3. The segment continued one half mile downstream ending above the Lower Reservoir. Along this segment, Foundry Brook runs parallel with Fishkill Road meandering between 10 to 150 feet from the roadside. The only obvious human impact was a paved road through the relatively dense forest surrounding the stream. Water was clear along the entire segment with healthy streamside cover and natural vegetated riparian zone. Few pools were noted and rocks on the streams bottom were embedded. Excessively silty runoff from erosion can increase a stream's embeddedness. No fish were observed, but many frogs and a nuthatch were observed.

**Indian Brook**

Waters flowing from a forested wetland just north of Indian Brook Rd near the Putnam Valley town line are the headwaters for Indian Brook. From the wetland the stream flows into Loch Lyall, a major impoundment, and continues toward the Hudson. It passes through three smaller impoundments along a dirt section of Indian Brook Road. Perennial streams flowing from Reeves Pond, Catfish Pond and an unnamed pond located west of Route 9 make Indian Brook a third order stream.

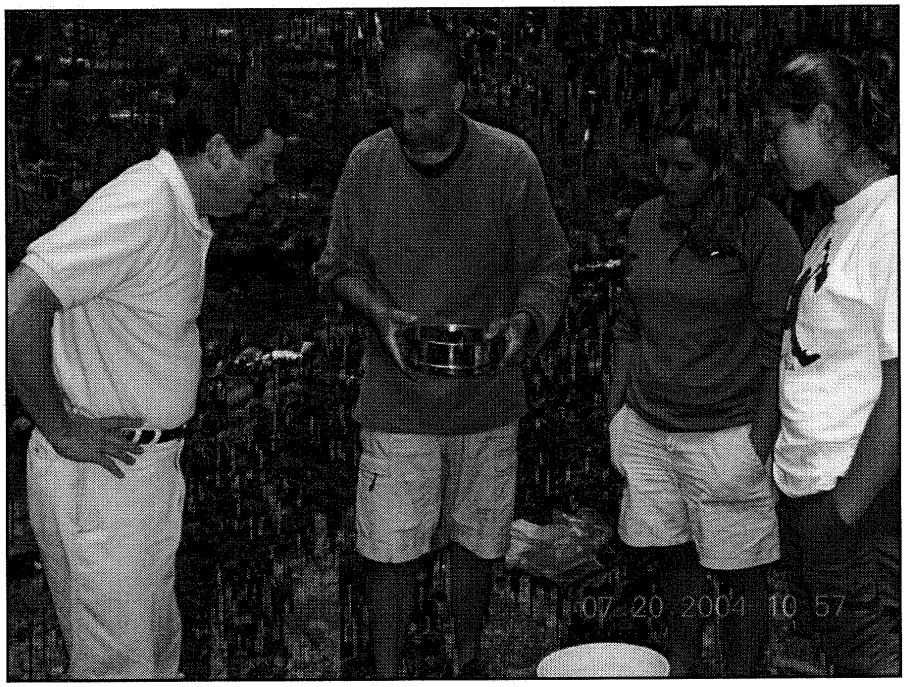
Two stream segments were selected along Indian Brook. IB-1 was located on the western side of the Route 9 bridge and followed downstream approximately .4 miles. The surrounding land use is rural and the area is privately owned. Depth measured an average of 7.5 inches across the segment. Stream width was an average of 14.75 feet. The calculated average velocity of the stream segment was .44 *cf/sec.* Stream banks were stable along the segment, and a high score was given for stream cover and width of riparian zone. Water appeared clear and very little litter was seen. Pools were present and approximately 20 fish were seen in each. A blue heron and a white heron are known to frequent these ponds. The only fish barrier along the segment was the culvert at the Route 9 bridge. Rocks in the silt-covered streambed were greater than 75% embedded. The overall habitat assessment score was *Fair.*

**IB-1 from Indian Brook Road looking downstream**

Interviews with landowners along IB-1 revealed a recent increase in flood events related to increased sedimentation of the stream. Generally, as rocks become embedded, there is less rock surface or space between rocks available as habitat for aquatic macroinvertebrates and for fish spawning. More investigation into the recent change in the stream's physical characteristics is recommended.

The second segment, IB-2 flowed .15 miles downstream from the NYC Aqueduct land. A visual assessment was completed at IB-2 while collecting a macroinvertebrate sample. The stream segment meandered through a forested area at the base of a narrow ravine. Water was very clear and small brown trout were identified. Stable banks and a riparian zone atleast twice the size of the active channel characterized the segment. A spring fed perennial stream flowed into the stream segment. The overall score IB-2 was *Excellent.*

Macroinvertebrates were collected at IB-2 and results indicated the stream segment was *non-impacted.* Sample analysis results indicate a high diversity of macroinvertebrate organisms, with 22 Families identified. Perlidae, commonly known as stoneflies, were the most common, representing 17% of the sample.




**Collecting macroinvertebrates at IB-22**

**Philipse Brook**

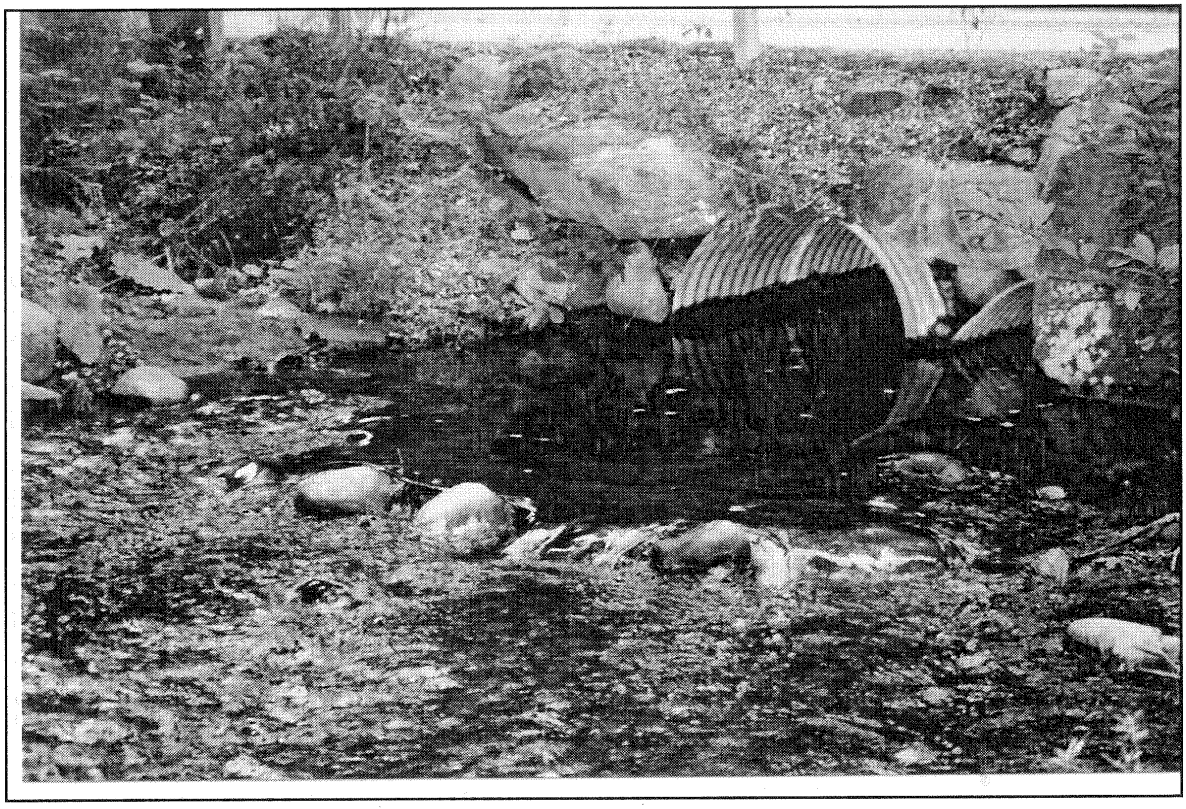
Philipse Brook originates from a seasonally flooded forested wetland in Clarence Fahnestock State Park. The 1.7-acre wetland located south of Duck Pond is listed by the National Wetland Inventory. From the forested wetland, water flows south toward South Highland Road, passing through additional wetland areas and crosses a local favorite hiking trail, Chimney Trail. The stream flows into Earl's Pond, owned and managed by the Garrison Fish and Game Club, and through the Saunders Farm. From here, the stream follows the same route as the road, traveling under Route 9, through the Garrison Golf Course, passing the Walter Hoving Home and eventually draining directly into the Hudson. Philipse Brook is approximately 5 miles long.

Four segments were selected along Philipse Brook. Philipse Brook 1 (PB-1) was located above Earl's Pond in Clarence Fahnestock State Park. Philipse Brook 2 (PB-2) followed Philipse Brook Road from Old Albany Post Road to Coyote Rise. From the Route 9 bridge to the next bridge downstream was the Philipse Brook 3 (PB-3) segment. The section of stream that flows through the Walter Hoving home was Philipse Brook 4 (PB-4) and the last segment, Philipse Brook 5 (PB-5) was a short segment just upstream from the Route 9D bridge. PB-5 was selected for macroinvertebrate analysis and is currently included in a benthic monitoring program sponsored by the NYSDEC.

From South Highland Road, walking upstream to the headwaters of Philipse Brook, the streamside cover was excellent along PB-1. There was little sign of erosion along the meandering stream. Water appeared clear and signs of a diverse aquatic plant community were present. Several old dams, a waterfall and evidence of previous flooding were noted. At the time of the survey, water temp was 60 F, the average depth of the segment was 6.25 inches, width was 9.5 feet and velocity was approximately 1.08 *cf/sec.* The overall score for PB-1 was *Good*

Downstream from Earl's Pond and west of Old Albany Post Road, PB-2 followed Philipse Brook Road and received an overall score habitat assessment score of *Fair.* The average depth of water along the stream was 1'1" and the average width of the stream was 14'8". Average velocity of flow was 1.5 *cf/sec.* This segment survey was completed 3 days after a heavy rainstorm that brought approximately 3 inches of rainfall in less than 12 hours. A natural riparian zone and streamside cover existed on only one side of the stream; the other side of the stream was adjacent to Philipse Brook Road. Few pools were present along the segment. Small areas of erosion along the streambank and evidence of past channel alteration were visible form this roadside assessment. Remnants from an old pulley, pump house pipes and old dams remain in the stream. More recent anthropogenic impacts include driveway crossing and stormwater discharge pipes. Litter was fairly common and seemed purposely dropped. Wild

life seen during the PB-2 segment survey include frogs, blue heron, red-tailed hawk, mourning dove, turkey vultures, dragonflies and a variety of water bugs and fish.



**Stormwater discharge pipe at PB-2**

The Route 9 overpass bridge was the beginning point for segment PB-3. The segment was approximately one half mile of stream following close to Philipse Brook Road and ended at the next bridge downstream. The surrounding landuse was rural residential with forested landscapes. The overall score for PB-3 was *Excellent.* The segment had deep shallow pools, clear water and there was evidence of flooding. Seasonally low water levels were the only barriers to fish movement. A vegetated riparian zone was absent along the roadside of the stream for short segments along the PB-3.

PB-4 received a *Poor* overall score, the lowest score of the segments assessed along Philipse Brook. The segment began on the north side of Snake Hill Road and extended one-quarter mile to Avery Road. Four dams, 4 discharge pipes and 4 bridges were tallied along this one-quarter mile stretch of Philipse Brook. The segment, most of which is channelized, had little streamside vegetation or tree canopy cover. Rocks were embedded firmly in the streambed and pools were mostly absent. The average velocity of flow through the segment was 5.5 *cf/sec.* Fish, one frog and a variety of birds were observed during the survey.

Macroinvertebrates were collected at PB-5 and the results indicate the segment to be *slightly to non-impacted.* The segment was approximately .15 miles just above the Route 9D bridge. The overall habitat assessment score for PB-5 was *Excellent.* Natural vegetation extended at least one active channel width and the canopy cover was greater than 60% of the stream. Water was clear with little sign of nutrient enrichment and a diverse aquatic plant community was noted. The meandering stream had pool and riffle characteristics and surrounding landuse was rural residential.

**PB-5 Macroinvertebrate collection site**

**Clove Creek**

Clove Creek originates in Fahnestock State Park from Wiccoppee Pass and flows north along Route 9 into Dutchess County. There it flows into Fishkill Creek and finally into the Hudson River. Clove Creek flows above one of four aquifers in the Hudson River basin that are designated a Primary-Water Supply Aquifer by the NYSDEC. As defined by the NYSDEC, a Primary-Water Supply Aquifer is a highly productive aquifer presently being utilized as a source of water supply by major municipal water supply systems. The Fishkill/Sprout Brook Aquifer is an underground rock formation that yields enough water for thousands of people in the Towns of Fishkill and Wappinger, City of Beacon and Village of Fishkill.

Four stream segments were selected along Clove Creek.

CC-1 began just below the pond at Glynwood Center and continued approximately .75 miles to the intersection of Route 301 and Glynwood Drive. The densely forested surrounding landscape is conserved as part of Clarence Fahnestock State Park. Physical characteristic calculations included, 1 foot for average depth of the stream, 20 feet for average width and the average velocity of the segment was .9 *cf/sec.* The stream flowed under 3 road bridges along Glynwood Drive, each reducing the steam width by approximately 30%. Human activity adjacent to the stream included vehicle traffic, hiking and bridle trails. Minimal little was spotted. A canopy cover that extended along more than 60% provided shade to the stream and the riparian zone extended more the 2 channel widths on each side of the stream. Water appeared very clear and the plant community was diverse. Evidence of natural flooding with no barriers limiting the stream's access to the flood plain was noted. Rocks were embedded firmly and stuck in sediments on the streambed. Wildlife identified during the assessment includes 3 blue jays, 5 chickadees, 1 ovenbird, 2 chipmunks and 1 wood thrush. No fish were observed. The overall habitat assessment score was *Good.*

CC-2 began at the end of Walmer Lane and followed downstream to Mill Road. The surrounding landuse of CC2 was identified as rural residential to densely forested. The water temp was 58F and the current and past 48 hour weather conditions were clear. Average width of the canopy cover over the stream was between 40-60%. There were small areas of erosion identified and the riparian zone extended at a minimum of one active channel width. The stream naturally meandered and no artificial embankments or barriers to fish movement were identified. The surrounding plant community was diverse and evidence of seasonal flooding was apparent. Rocks were 25–50% embedded and were easily turned over. The overall habitat assessment score was *Excellent.*

A macroinvertebrate sample was collected at CC-2. The results of an EPT and Family Richness calculation indicate the stream segment was *slightly to non-*

*impacted.* The dominant Family, Heptageniidae and Oligoneuridae, flatheaded mayflies and brushlegged mayflies represented 50% of the sample.

**CC-3 Stream corridor**

The stream continues to flow north along Route 9. CC-3 began at the bridge on Route 9 and followed the stream 1/5 mile to the bridge at Old Albany Post Road North. The overall habitat assessment score was *Good.* The surrounding landuse is a mix of commercial and residential with industrial uses nearby. There is a large paved parking lot in proximity to the segment. Impervious surfaces can negatively affect a stream by increasing the rate and temperature of stormwater runoff that enters the stream. Average width of the segment was 24′ and average width was 2.2′. Weather conditions were overcast and dry, with no precipitation in the previous 48 hours of the segment survey. The air temperature was 70F and water temp was 62F at 1:00PM. The average velocity of the stream was calculated to be 12*cf/sec.* No dams were identified on the segment but 2 individual drainpipes diverting stormwater from Route 9 were identified. Natural vegetation extended at least 2 active channel widths and the canopy covered 40% - 60% of the stream. Banks along the segment were moderately stable with small areas of erosion near Route 9. The channel naturally meandered and no barriers to fish movement were present along the segment. Water appeared very clear and no litter was found. One great blue heron was seen along the segment, as well as a dead 14″ brook trout and a dead crayfish.

**Trash along shore at CC-4**

The northern most segment of Clove Creek, CC-4 extended from Albany Post Road to Snow Valley Campground. A detailed habitat assessment and water quality analysis of CC-4 was completed over 2 days and is available on Table 1. In general, stream vegetation and insects were absent. Silt and mud was prevalent and the substrate was greater than 75% embedded. Pools were absent along a majority of the segment. CC-4, while just downstream from CC-3 showed signs of environmental stressors. Sections of discolored water, discharge pipes and trash were noted. Surrounding industrial land uses may be negatively impacting this section of Clove Creek. More investigation is recommended to identify the impact of surrounding landuse on this important drinking water source.

## RECOMMENDATIONS

The habitat assessment and macroinvertebrate analysis was designed to establish a baseline for future monitoring. Habitat assessments indicated more than half of the selected segments are *Good* to *Excellent* quality habitats. Macroinvertebrate analysis revealed of the 4 streams segments where macroinvertebrates were collected only one segment was *moderately impacted.*

To help protect these water resources the following are recommended:

- ***Further investigation into the cause of Poor to Fair habitat assessment scores and impacted stream segments***
  Five of 14 survey sites had Fair to Poor habitat assessment scores or were identified as *moderately impacted.* To prevent further habitat degradation and consider restoration efforts, the source of the impact should be identified and addressed.

- ***Continue to monitor segments and expand survey to include more segments and additional streams***
  Volunteer based stream assessment programs are an effective way to educate residents about stream health and collect important and useful data. Focus monitoring efforts on areas where stream restoration may be needed but do not neglect area known to have high habitat value.

- ***Restore stream banks that are severely eroded***
  Eroding soil from stream banks can increase turbidity in the stream. Elevated turbidity levels affect stream health by decreasing the rate of photosynthesis of aquatic plants therefore, reducing available dissolved oxygen. Suspended materials can clog fish gills too. Re-vegetation is an effective way to improve eroded stream banks. A list of native riparian trees and shrubs is available in the Appendix of this report.

- ***Provide educational outreach, training, and workshops on water quality***
  These workshops can educate residents on the existing conditions of surface water in Philipstown and introduce ways they can help protect our streams. Informational fact sheets about stream health can be developed and distributed to streamside landowners.

- *Discourage landowners from mowing to the edge of the streambank*
  Mowing right to the stream may look nice, but it actually has negative impacts on the stream. Streamside vegetation acts as a filter for excess nutrient run off, helps moderate water temperature by providing shade and holds the soil in place to reduce erosion. Vegetation along the stream provides wildlife habitat and contributes to biodiversity by helping to create a healthy ecosystem.

- *Protect stream buffer areas to maintain stream integrity*
  A bank covered in natural vegetation with a low sloping gradient provides stability and habitat for a variety of aquatic and terrestrial species. It is important to maintain these buffers areas to prevent resource degradation.

- *To help reduce the impact of litter while raising awareness of our water resources, sponsor "Streamside Cleanup Days"*
  Litter appeared purposefully dropped along at least two segments during the physical assessment survey. To help reduce the impact of litter and compliment existing enthusiasm among roadside cleanup volunteers, develop clean up days along streams. Programs including "adopt a stream" could involve existing volunteer or hobby groups, school children and civic associations.

## GLOSSARY

**Active channel width:** The width of the stream at the bankfull **discharge**. Permanent vegetation generally does not become established in the active channel.

**Algae:** Refers to all microscopic photosynthetic organisms including diatoms and blue-green algae

**Canopy cover**: The percentage of the stream shaded by vegetation.

**Channel:** A natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks that serve to confine the water.

**Channelization:** Straightening of a stream channel to make water move faster.

**Confined channel:** A channel that does not have access to a flood plain.

**Culvert:** A human-made construction that diverts the natural flow of water.

**Degradation:** Geologic process by which a stream bottom is lowered in elevation due to the net loss of bottom material. Often called downcutting.

**Discharge:** The amount of water passing through a given point for a given length of time.

**Dissolved Oxygen:** Oxygen that has been dissolved in water, aquatic organisms rely on dissolved oxygen to breathe.

**Downstream:** In the direction of a stream's current; in relation to water rights, refers to water uses or locations that are affected by upstream uses or locations.

**Embeddedness:** The degree to which an object is buried in steam sediment.

**Emergent plants:** Aquatic plants that extend out of the water.

**Flood plain:** The flat area of land adjacent to a stream that is formed by current flood processes.

**Gradient:** Slope calculated as the amount of vertical rise over horizontal run

**Habitat:** The area or environment in which an organism lives.

**Headwaters:** The source of a stream.

**Hydrology:** The study of the properties, distribution, and effects of water on the Earth's surface, soil, and atmosphere.

**Incised channel:** A channel with a streambed that is currently lower in elevation than its past elevation (in relation to the flood plain).

**Intermittent stream:** A stream in contact with the ground water table that flows only certain times of the year, such as when the ground water table is high or when it receives water from surface sources.

**Macroinvertebrate:**. A spineless animal visible to the naked eye or larger than 0.5 millimeters.

**Meander:** A winding section of stream with many bends.

**Perennial stream:** A steam that flows continuously throughout the year.

**Pool:** Deeper area of a stream with slow-moving water.

**Reach:** A section of stream with consistent characteristics).

**Riffle:** A shallow section in a stream where water is breaking over rocks, wood, or other partially submerged debris and producing surface agitation.

**Riparian Zone:** The zone adjacent to a stream (from the Latin word ripa, pertaining to the bank of a river, pond, or lake).

**Riprap:** Rock material of varying size used to stabilize streambanks and other slopes.

**Scouring:** The erosive removal of material from the stream bottom and banks.

**Silt:** Sediment material consisting of particles intermediate in size between sand and clay

**Substrate:** The mineral or organic material that forms the bed of the stream; the surface on which aquatic organisms live.

**Tributary:** A body of water that drains into another, typically larger body of water.

**Turbidity:** Murkiness or cloudiness of water caused by particles, such as fine sediment (silts, clays) and algae.

**Watershed:** A ridge of high land dividing two areas that are drained by different river systems. The land area draining to a waterbody or point in a river system; catchment area, drainage basin, drainage area.

## METHODS

### Visual Habitat Assessment

Volunteer participants of Streamwalk completed the habitat assessment of each stream. Streamwalk was a volunteer based stream monitoring program that served two purposes: natural resource assessment and community involvement and education. The program actively involved members of the community in resource conservation efforts, and increased awareness and understanding of water resource related issues. Similar programs have proved successful in neighboring areas including the Fishkill Creek watershed and throughout watersheds in Westchester County.

The Philipstown Streamwalk program was based on similar programs developed by the Hudson Basin River Watch and the Lower Hudson Coalition of Conservation District.

Volunteer recruitment for Streamwalk began in early summer 2004. Postcards announcing the program and inviting anyone interested to attend an upcoming training workshop were mailed to all landowners adjacent to the four streams in the study area and all current Hudson Highlands Land Trust volunteers. Postcards were forwarded to our local government agencies and displayed at various public places. Recruitment continued town wide with newspaper and website advertisements announcing the first of two workshops scheduled in August 2004. The Putnam County News and Recorder also ran a feature story about our project.

Just over a dozen volunteers participated in the workshops. The workshop attracted young people, families with small children and senior citizens. The workshop focused on how to properly assess physical parameters including flow, turbidity and canopy cover and how each can impact the condition of our "living streams".

A handful of volunteers who could not attend our workshop came to the Land Trust office for a brief one-to-one training session.

Quantitative measurement is not within the scope of the Streamwalk information collection process. However, to minimize subjectivity all volunteers were required to participate in a training session in order to review the data collection sheets and to familiarize themselves with basic stream ecology/morphology and water quality concepts.

Upon completing the training workshop, volunteers were assigned to a stream segment and given a stream assessment kit. Stream assessment kits included the following:

- Survey data sheets and overall score sheets
- Stream assessment factors description
- Glossary of terms
- Thermometer
- Litmus paper
- Measuring tape
- Rubber gloves
- Disposable camera

Using the Survey Data Sheets, volunteers recorded their observations as they walked upstream along the stream segment. Volunteers assessed physical characteristics of their stream segment including, riparian zone, flow, channel condition and bank stability. Air and water temperature, stream width and depth, pH and surrounding land use characteristics were also collected.

Volunteers were asked to note on their survey sheets, in their opinion, any impaired site in the stream segment. Impairments included fish barriers and storm water discharge pipes. A disposable camera was provided in each volunteer packet so volunteers could photo-document their findings.

Completed Survey Data and Score Sheets were to be returned one month after the workshop. This gave the volunteers some flexibility with their time commitment. All surveys were completed and returned to the Hudson Highlands Land Trust office by September 30, 2004.

**Macroinvertebrate Assessment**

In some ways, macroinvertebrates are better indicators of stream condition than fish. Macroinvertebrates are much less mobile than fish and can more accurately reflect the condition of the stream reach in which they are found. Different species respond to different types of stresses and habitat features. Therefore, conclusions can be drawn about the current stream condition by identifying and inventorying the macroinvertebrates within the stream.

A Total Family Richness calculation measures the diversity of macroinvertebrates, how many different types of organisms are found. The value of this measurement tends to decrease as water quality becomes impaired. The Dominant Family calculation measures the abundance of the most commonly found organism as a percent. This value tends to increase as pollution is added to water. Those species that are sensitive to pollutants will die and pollution tolerant

species will thrive. Mayflies, stoneflies, and caddisflies are typically used in biological monitoring because they are generally intolerant of silt, warm temperatures, and water quality degradation. EPT richness is the number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa found in a stream reach.

Macroinvertebrate samples were collected using the "kick sampling method" outlined in the Quality Assurance Work Plan for Biological Stream Monitoring in New York State. Preliminary visits to each stream occurred from April to June 2004 and one sample site per stream was selected for macroinvertebrate sampling. As recommended, the selected sample sites were riffle areas less than one meter deep. Sampling occurred between July and September.

Using the recommended aquatic net, samples were collected for 5 minutes for a distance of 5 meters. After removing large debris from the sample, a number 30 standard sieve was used to further filter each sample. All samples were preserved at the site using 95% ethyl alcohol.

Macroinvertbrate sample sorting and identification was completed at the Constitution Marsh Audubon Sanctuary offices and laboratory. Each sample was divided into 6 subsections and one subsection was selected randomly to be examined. One hundred organisms from each subsample were identified to Family level.

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Table 1: Streamwalk Habitat Assessment Results

| Segment | Overall Score | Data Collected By | Date | ıth | pH | Avg velocity *cf/sec* | Small ponds | Dams |
|---|---|---|---|---|---|---|---|---|
| **CC-1** | *Good* | Peter Calllaway | 09/27/04 | | 6.5 | 1 | 0 | 0 |
| **CC-2** | *Good* | E. Lind | 09/27/04 | | | 0.43 | 2 | 0 |
| **CC-3** | *Excellent* | Landon Evarts | 09/14/04 | | 7 | 12 | 0 | 0 |
| **CC-4** | *see Table 2* | Curtis Zimmerman | | | | | | |
| **FB-1** | *Fair* | Rubino Family | 10/24/04 | | 7 | 0 | 0 | 0 |
| **FB-2** | *Good* | Rubino Family | 12/24/04 | | 7 | 0 | 1 | 0 |
| **FB-3** | *Fair* | Peter Callaway | 09/27/04 | | 6.5 | 1 | 0 | 0 |
| **IB-1** | *Fair* | Paula Van Aiken | 09/11/04 | | 6 | 0.46 | 3 | 2 |
| **IB-2** | *Excellent* | Macro Site | 07/20/04 | | - | - | 4 | 1 |
| **PB-1** | *Good* | Greg & Jan Buhler | 09/25/04 | | 7 | 1 | 6 | 1 |
| **PB-2** | *Fair* | Susan Jordan Bev Taylor | 09/12/04 | | 5.5 | 1 | 0 | 3 |
| **PB-3** | *Good* | Joyce Zern | 08/26/04 | | 7.5 | 4 | 5 | 1 |
| **PB-4** | *Poor* | Wilson Family | 08/26/04 | | 7 | 5 | 1 | 5 |
| **PB-5** | *Good* | Macro Site | 09/27/04 | | - | - | 5 | 0 |

| Segment | Discharge Pipes | Vehicle crossing | Human activities | ıce | Nutrient enrichment | Hydrology | Litter |
|---|---|---|---|---|---|---|---|
| **CC-1** | 3 | 3 | hiking trails, access road, | | 10 | 10 | 10 |
| **CC-2** | 0 | 1 | none | | 10 | 10 | 10 |
| **CC-3** | 2 | 2 | stream passses under Route 9 - | | 10 | 10 | 10 |
| **CC-4** | | see Table 2 | | | | | |
| **FB-1** | 0 | 0 | little trash | | 7 | 10 | 10 |
| **FB-2** | 0 | 1 | small amount of litter | | 9 | 7 | 7 |
| **FB-3** | 0 | 0 | isolated picnicing, beer bottles | | 9 | 10 | 5 |
| **IB-1** | 0 | 0 | none | | 10 | 10 | 9 |
| **IB-2** | 0 | 0 | none | | 10 | 10 | 10 |
| **PB-1** | 2 | 0 | stream is parallel with hiking trail, | | 10 | 0 | 7 |
| **PB-2** | 7 | 5 | litter, old pulley and pumphouse | | 10 | 7 | 3 |
| **PB-3** | 1 | 5 | little trash, dirt road | | 9 | 10 | 9 |
| **PB-4** | 4 | 1 | swimming hole, channelized | | 8 | 1 | 7 |
| **PB-5** | 1 | 2 | little trash | | 8 | 9 | 9 |

Table 2

## Clove Creek Stream Walk Raw Data

| Site | Temp (°C) | Curr. W | W Past 48 Hr. | Surr. Land Use | Str. Depth (at mid, ft) | Str. Width (ft) | pH | Str. V (sec/ 20ft) {ft/min} | Coordinates & Elevation | Ponds, Dams Dis., Cross | Rip Z | Str. C | BS | CC | BFM | EMB | P | WA | NE | H | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 64 | over cast | clear | camp ground | 1 | 18 | 6.5 | 30,25 ,30 {42} | 41°29.75n 73°54.32w 240ft | na | 7 | 7 | 3 | 10 | 10 | 1 | 1 | 10 | 10* | 10 | 1 |
| 2 | 64 | " | " | wooded flood plain | 1 | 30 | 6.5 | 30,27 25 {43} | 41°29.74n 73°54.37w 242ft | na | 7 | 7 | 3 | 10 | 10 | <1 | 1 | 10 | 10* | 10 | 10 |
| 3 | no | data | only photo | near steep mtn. | better rock stream | bed | | | 41°29.75n 73°54.41w 249ft | | | | | | | | | | | | |
| 4 | 64 | over cast | claer | wooded flood plain | <1 | 39 | 6.5 | 47,46 ,51 {25} | 41°29.74N 73°54.42W 267ft | na | 10 | 3 | 1 | 10 | 10 | <1 | 1 | 10 | 10* | 10 | 7 |
| 5 | 63 | " | " | Boarder steep slope by pit, wooded flood plain | <1/2 | 19 | 6.5 | 16,15 ,12 {83} | 41°29.66N 73°54.43W 291ft | na | 10 | 10 | 7 | 10 | 10 | 7 | 1 | 10 | 10* | 10 | 10 |
| 6 | No, data. Photo array at South end of Quarry | | | | | | | | 41°29.60N 73°54.42W 291ft | | | | | | | | | | | | |
| 7 | 60 | Cloud /sun | Over-cast | Wooded plain | 3.5 | 20 | 6.5 | 65,70 ,73 {17} | 41°29.59N 73°54.46W 291ft | na | 10 | 10 | 7 | 10 | 10 | 7 | 7 | 10 | 10* | 10 | 10 |
| 8 | 60 | " | Pricker Bush | Woods/ P bush | <0.5 | 18 | 6.5 | 12,10 ,11 {109} | 41°29.53N 73°54.48W 291ft | na | 10 | 10 | 3 | 10 | 10 | 7 | 1 | 10 | 10* | 10 | 10 |
| 9 | 3 picture mosaic. No data | | | | | | | | 41°29.47N 73°54.47W 291ft | | | | | | | | | | | | |
| 10 | 2 picture mosaic | | | | | | | | 41°29.45N 73°54.46W 291ft | | | | | | | | | | | | |
| 11 | 2 picture mosaic | | | | | | | | 41°29.45N 73°54.43W 291ft | | | | | | | | | | | | |
| 12 | 62 | Cloud /sum | Over-cast | woods | <0.5 | 19 | 6.5 | 9,13 ,11 {109} | 41°29.44N 73°54.41W 291ft | na | 10 | 1 | 7 | 10 | 10 | 10 | 1 | 10 | 10* | 10 | 10 |
| 13 | 62 | " | " | " | 2.5 | 18 | 6.5 | 79,120 ,90 {12} | 41°29.41N 73°54.40W 291ft | na | 10 | 1 | 3 | 10 | 10 | 1 | 3 | 10 | 10* | 10 | 10 |

Table 3 - Macroinvertebrate Results

| ORDER | FAMILY | COMMON NAME | Indian Brook 7/20/2004 | Foundry Brook 9/28/2004 | Philipse Brook 9/28/2004 | Clove Creek 9/28/2004 |
|---|---|---|---|---|---|---|
| Odanata | Aeshnidae | darner dragonflies | 3 | | | |
| Crustacea | Assellidae | aquatic snowbug | | | 1 | |
| Athericidae | Athericidae | watersnipe fly | 1 | | | |
| Ephemeroptera | Baetadae | small minnow mayflies | | | 1 | 2 |
| Trichoptera | Capniidae | stoneflies | 2 | | | |
| Chironimidae | Chironomidae | midges | 5 | | | |
| Odanata | Cordulegastridae | spiketail dragonflies | 1 | | | |
| Megaloptera | Corydalidae | fishflies and dobsonflies | 12 | 4 | 6 | 8 |
| Elmidae | Elimidae | riffle beetles | 1 | | 4 | |
| Ephemeroptera | Ephemerellidae | spiny crawlers | 1 | | 13 | 1 |
| Trichoptera | Glossosomatidae | caddisflies | 8 | | | |
| Odanata | Gomphidae | clubtail dragonflies | 12 | | 1 | 1 |
| Ephemeroptera | Heptageniidae | flatheaded mayflies | 6 | 6 | 3 | 25 |
| Trichoptera | Hydropsychidae | common netspinners | 11 | 45 | 44 | 14 |
| Trichoptera | Leptoceridae | caddisflies | 3 | | | |
| Diptera | Tipulidae | craneflies | 1 | | | 1 |
| Oligochaeta | Oligochaeta | aquatic earthworms | | 20 | 1 | 11 |
| Ephemeroptera | Oligoneuridae | brushlegged mayflies | | | | 25 |
| Plecoptera | Peltoperlidae | stoneflies | | 1 | | |
| Plecoptera | Perlidae | stoneflies | 17 | | 7 | 3 |
| Plecoptera | Perlodidae | stoneflies | 1 | | | |
| Trichoptera | Philopotamidae | fingernet caddisflies | 5 | 3 | 10 | 1 |
| Trichoptera | Polycentropodidae | caddisflies | 1 | | | |
| Coleoptera | Psephenidae | water pennies | 5 | 14 | 6 | 6 |
| Plecoptera | Pteronarcyidae | stoneflies | 1 | | | |
| Trichoptera | Rhyacophilidae | freeliving caddisflies | 2 | 7 | 3 | 1 |
| Megaloptera | Sialidae | alderflies | 1 | | | 1 |
| Diptera | Tabinidae | horseflies | | 1 | | |
| | | Total Organisms | 100 | 100 | 100 | 100 |
| | | EPT Richness | 12 | 5 | 6 | 7 |

Appendix XII. FAMILY-LEVEL MACROINVERTEBRATE INDICES

1. Family richness. This is the total number of macroinvertebrate families found in a riffle kick sample. Expected ranges for 100-organism subsamples of kick samples in most streams in New York State are: greater than 13, non-impacted; 10-13, slightly impacted; 7-9, moderately impacted; less than 7, severely impacted.

2. Family EPT richness. EPT denotes the orders of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera). These are considered to be mostly clean-water organisms, and their presence generally is correlated with good water quality (Lenat, 1987). The number of EPT families found in a 100-organism subsample is used for this index. Expected ranges from most streams in New York State are: greater than 7, non-impacted; 3-7, slightly impacted; 1-2, moderately impacted; and 0, severely impacted.

3. Family Biotic Index. The family-level Hilsenhoff Biotic Index is a measure of the tolerance of the organisms in the sample to organic pollution (sewage inputs, animal wastes) and low dissolved oxygen levels. It is calculated by multiplying the number of individuals of each family by its assigned tolerance value, summing these products, and dividing by the total number of individuals. On a 0-10 scale, tolerance values range from intolerant (0) to tolerant (10). Values are listed in Hilsenhoff (1988); additional values for non-arthropods are assigned by the NYS Stream Biomonitoring Unit. The most recent values are listed in the Quality Assurance document (Bode et al., 1996). Ranges for the levels of impact are: 0-4.50, non-impacted; 4.51-5.50, slightly impacted; 5.51-7.00, moderately impacted; and 7.01-10.00, severely impacted.

4. Percent Model Affinity is a measure of similarity to a model non-impacted community based on percent abundance in 7 major groups (Novak and Bode, 1992). Percentage similarity is used to measure similarity to a community of 40% Ephemeroptera, 5% Plecoptera, 10% Trichoptera, 10% Coleoptera, 20% Chironomidae, 5% Oligochaeta, and 10% Other. Ranges for the levels of impact are: >64, non-impacted; 50-64, slightly impacted; 35-49, moderately impacted; and <35, severely impacted.

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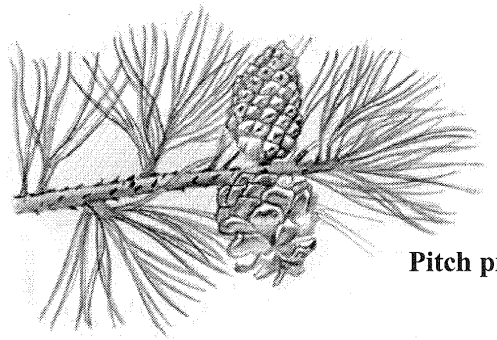
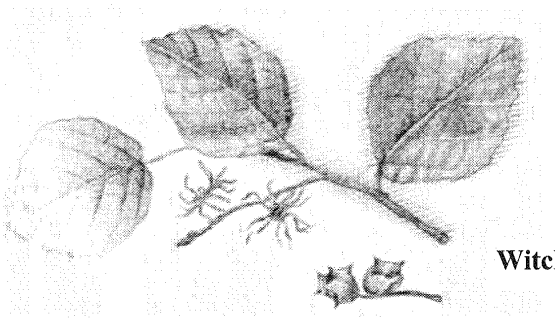
# NATIVE RIPARIAN ZONE TREES

## Overstory

American beech - Fagus grandifolia
Atlantic white cedar - Chamaecyparis thyoides
Bitternut hickory - Carya cordiformis
Black oak - Quercus velutina
Black spruce - Picea mariana
Black willow - Salix nigra
Chestnut oak - Quercus prinus
Eastern hemlock - Tsuga canadensis
Green ash - Fraxinus pennsylvanica
Hackberry - Celtis occidentalis
Larch or Tamarack - Larix laricina
Linden or Basswood - Tilia americana
Mockernut hickory - Carya tomentosa
Pignut hickory - Carya glabra
Pin oak - Quercus palustris
Pitch pine - Pinus rigida
Red oak - Quercus rubra
Red pine - Pinus resinosa
Red spruce - Picea rubens
River birch - Betula nigra
Scarlet oak - Quercus coccinea
Shagbark hickory - Carya ovata
Slippery elm - Ulmus rubra
Sugar maple - Acer saccharum
Swamp white oak - Quercus bicolor
Sweet or Black birch - Betula lenta
Sycamore - Platanus occidentalis
Tuliptree - Liriodendron tulipifera
White ash - Fraxinus americana
White pine - Pinus strobus
Yellow birch - Betula alleghaniensis



**Pitch pine**



**Witch hazel**

## Understory

Alternate-leaf dogwood - Cornus alternifolia
Aromatic sumac - Rhus aromatica
Black gum - Nyssa sylvatica
Blackhaw - Viburnum prunifolium
Choke cherry - Prunus virginiana
Downy juneberry - Amelanchier arborea
Flowering dogwood - Cornus florida
Gray birch - Betula populifolia
Hophornbeam - Ostrya virginiana
Hoptree - Ptelea trifoliate
Mountain maple - Acer spicatum
Nannyberry - Viburnum lentago
Possumhaw - Viburnum nudum
Prickly ash - Zanthoxylum americanum
Red cedar - Juniperus virginiana
Shadbush - Amelanchier Canadensis
Smooth alder - Alnus serrulata
Smooth juneberry - Amelanchier laevis
Speckled or rough alder - Alnus incana
Winged sumac - Rhus coppalina

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Adapted from: "Restoring NJ Riparian Forest Buffers", Rutgers University

# NATIVE RIPARIAN ZONE SHRUBS

American bladdernut - Staphylea trifolia
American hazelnut - Corylus americana
American strawberry-bush - Euonymus americanus
Arrowwood - Viburnum dentatum
Beaked hazelnut - Corylus cornata
Black chokeberry - Aronia melanocarpa
Buttonbush - Cephalanthus occidentalis
Common ninebark - Physocarpus opulifolius
Elderberry - Sambucus canadensis
Gray dogwood - Cornus racemosa
Highbush blueberry - Vaccinium corymbosum
Maleberry - Lyonia ligustrina
Maple-leaved viburnum - Viburnum acerifolium
Meadowsweet - Spirea latifolia
Mountain laurel - Kalmia latifolia
Northern bayberry - Myrica pennsylvanica
Pinxterbloom azalea – Rhod. periclymenoides
Purple chokeberry - Aronia prunifolia
Pussy willow - Salix discolor
Red chokeberry - Aronia arbutifolia
Redosier dogwood - Cornus stolonifera
Rosebay rhododendron – Rhod. maximum
Round-leaved dogwood - Cornus rugosa
Silky dogwood - Cornus amomum
Spicebush - Lindera benzoin
Steeplebush - Spirea tomentosa
Swamp azalea - Rhododendron viscosum
Swamp rose - Rosa palustris
Sweet pepperbush - Clethra alnifolia
Sweetfern - Comptonia peregrina
Virgin's bower - Clematis virginiana
Winterberry - Ilex verticillata
Witherod - Viburnum cassenoides

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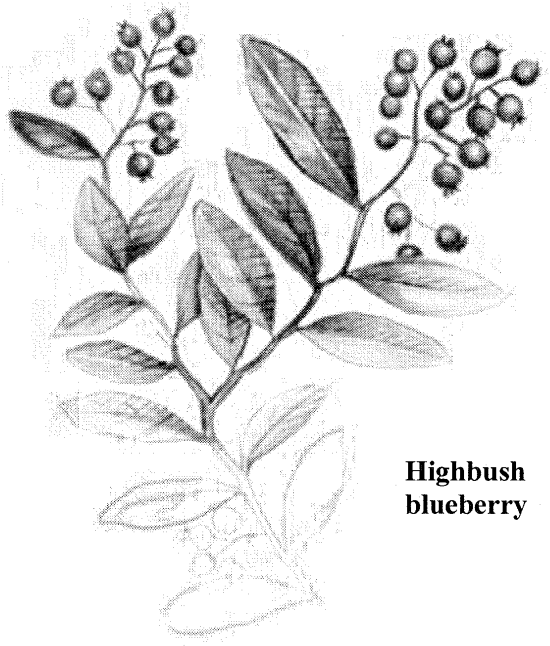

**Highbush blueberry**

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